

ART. XV.—*A Practical Treatise on Foreign Bodies in the Air-passages.* By S. D. GROSS, M. D., Professor of Surgery in the University of Louisville; Member of the American Philosophical Society; Author of "Elements of Pathological Anatomy," "A Treatise on the Diseases of the Urinary Organs," &c. With Illustrations. 8vo. pp. 468. Philadelphia: Blanchard & Lea.

BUT few subjects in the range of medicine or surgery are more important than that of foreign bodies in the air-passages; and yet, strange to say, there is scarcely a treatise or monograph, up to the present time, in which this subject has received that attention and investigation which it demands. It is to fill this vacancy in the history of our science that the labours of Dr. Gross have been especially directed upon the present occasion. In his preface, he states that his "design originally was, not to write a book, but to compose a short monograph for some medical journal." The author, however, had not proceeded far in his investigations before he found that the subject was far more comprehensive than he had at first imagined, and that, to do it anything like justice, it would not only require more space, but also much more time and study than anticipated. And, in fact, it must be admitted that it has been no easy task to collect, analyze, compare, and, finally, deduce correct general principles from the scattered facts throughout our various periodicals, upon this important subject. The result has been a very respectable volume, consisting of four hundred and sixty-eight pages, and containing, besides much other very interesting matter, some fifty cases of the accident now under consideration, which for the first time meet the public eye. Besides this, an abstract of upwards of two hundred cases, extracted from the medical press of this and other countries, is contained in this work, and forms, as the author most justly remarks, "one of its most important elements."

When we bear in mind the frequency of the accident, the helpless age at which it most commonly occurs, the agonizing suffering of the patient, and the prompt and decided action required to prevent impending death, it is not surprising that the author has devoted so much zeal and industry to the investigation of this subject. He admits that reflections of this character impelled him to write this treatise, and adds, that "if, in the providence of God, the work shall be instrumental in saving the life of one human being, or even in ameliorating the suffering of a single individual," he will feel himself amply remunerated for the time and toil bestowed upon its composition.

The first chapter is devoted to the general consideration of the character of the bodies which may enter the air-passages, the alterations they may undergo during their sojourn in these parts, the situations they most generally occupy, and, finally, the various routes by which they gain admission or may be expelled. The substances may consist of almost every conceivable form, from the vegetable, animal, and mineral kingdoms; but these, of course, are not alike liable to undergo rapid and important alterations from the effects of heat and moisture, which they necessarily encounter in the air-passages. Pills, particles of sugar, or crumbs of bread may readily undergo complete or partial solution, and thus be expelled, or, at most, induce but temporary inconvenience; but Dr. Gross very properly condemns the absurd notions, entertained by some, as to the softening power of the air-passages upon hard substances, such as grains of corn, melon-seed, beans, and even cherry-stones—substances which, indeed, almost defy the solvent powers of the gastric

juice. He points out the great danger of delay from trusting to such unfounded expectations, and states that "we might as well wait for the softening and disintegration of the Rock of Gibraltar by the waters of the Atlantic and Mediterranean, as for the softening and disintegration of a persimmon-stone or a piece of gristle by the heat and moisture of the air-passages;" a strong expression, but perhaps not too much so for so absurd a notion. In this chapter he alludes to a case in which a grain of maize, and to another in which a grain of corn exhibited signs of germination when removed from the lungs. It is well known that most vegetable substances greatly increase in bulk from remaining long in contact with the mucous membrane, and thus greatly diminish the chance of their being expelled through the glottis. A remarkable exception to this rule was recently observed by the writer of this notice, in the case of a little child who had a coffee-grain in the air-passages for more than three years, without its having undergone any perceptible alteration, either in bulk or consistency. Although mineral or other hard substances are not liable to any increased bulk from the above causes, yet it is well known that, when long retained, they are often coated with inspissated mucus, or even incrustated with carbonate and phosphate of lime.

In regard to the situation which foreign bodies most commonly occupy, the researches of the author fully confirm the generally received opinion that it is in the right bronchus. Dr. Stokes, in his short monograph upon this subject, alludes to the fact, as first pointed out by Dr. Goodall, of Dublin, that the septum or ridge which separates the right from the left bronchus, being to the left of the mesian line, necessarily tends to direct all foreign substances into the right. This effect is no doubt promoted by the larger dimensions of the right tube, but not, as has been supposed, by its comparatively horizontal position, since, in reality, the descending body would naturally tend to enter the left, which is most vertical. A small and smooth body, particularly if it be at the same time heavy, as a bullet, pebble, or shot, will be much more likely to descend into the bronchus than one which is light and large, or rough; and Dr. Gross expresses the opinion that many cases of sudden death, which, by a coroner's inquest, have been set down—"died by the visitation of God," have, in reality, been owing to the impaction of some particle of food in the very "door of the windpipe." Although, as a general rule, the foreign body obtains admission through the chink of the glottis, yet occasionally they have ulcerated their way through from the pharynx. An instance of this kind occurred quite recently in the wards of the Pennsylvania Hospital, in the case of a man who had several false teeth lodged in the pharynx, and which finally produced an ulcerated opening into the larynx. At other times, the substance may enter through a penetrating wound of the neck. Dr. Gross also alludes to cases in which the foreign body, having passed into the throat, excited ulceration of the lung, and was finally discharged through a fistulous opening between the ribs.

Allusion is likewise made to numerous cases of sudden death from the impaction of bodies upon the rima of the glottis. "Diseases of the epiglottis, disqualifying it for the due performance of its functions, remarkably predispose to this occurrence." "A person labouring under delirium tremens, and confined so as to be unable to move, may, in an effort at vomiting, instantaneously perish from the introduction of food into the air-passages." (p. 60.) But even where the "immediate effects of foreign bodies" (which forms the subject-matter of Chapter II.) are not so unfavourable, the author proceeds, in the third chapter, to the consideration of the remote or "pathological effects;" and here shows that, although the dangers are not so imminent, they

are nevertheless very urgent. The most usual of these are softening, thickening, and ulceration of the mucous membrane; and, at a more advanced period, pneumonia, pulmonary abscess, pleuritis, tubercle, &c. "It is a singular fact that the pathological changes now enumerated may all occur, to a greater or less extent, in cases where the obstruction is seated, not in the lungs or bronchial tubes, but in the larynx or upper part of the trachea."

Chapters IV. and V. are devoted to the consideration of the symptoms and diagnosis of this accident, and certainly constitute one of the most interesting parts of the work. The introduction of the body, in nearly every instance, gives rise to a severe paroxysmal cough, with impending suffocation; this is followed by a deceitful calm, lasting for several hours, or even an entire day; but, sooner or later, the symptoms recur even with increased intensity. When the case becomes more chronic, a new train of symptoms set in; the cough is less violent, though readily excited by the least motion; the expectoration becomes purulent; and, finally, hectic fever and general impairment of health supervene. By some, much importance has been attached to the sensation of pain as indicating the locality of the foreign body; upon this point, Dr. Gross remarks:—

"The pain does not always follow the introduction and lodgement of a foreign body in the air-passages, and that, when present, it varies much in degree as well as in character. Generally speaking, it is very slight, while sometimes it is excessively violent. It may come on at the moment of the accident, or it may not show itself until some time after, perhaps not until the resulting inflammation has produced serious structural lesions."

As this symptom is sometimes entirely absent, and inasmuch as, when present, it may depend upon so many other causes, it is generally admitted that it is of but little or no importance in a diagnostic point of view. A peculiar "flapping noise" has occasionally been heard, both by the patient and physician, in cases where the foreign body has been movable, occasionally ascending into the larynx, and again descending into the bronchial tubes; but similar sounds may be produced by the presence of inspissated mucus, or pieces of false membrane floating up and down the air-passages, and causing a "flip-flap" sound, which could not well be distinguished from that produced by a movable foreign body. Confessedly one of the most important means of forming a correct diagnosis is that derived from auscultation and percussion; all the others may entirely, or in a great measure, fail. Dr. Gross, indeed, mentions several interesting cases, where, from the absence of well-marked general symptoms, no suspicion of the real nature of the case had been entertained, and was only revealed by an examination *post mortem*. As a general rule, when the body is smooth and round, it will more or less completely obstruct one of the larger or smaller bronchial tubes; and, as a necessary consequence, the respiratory murmur will either be entirely destroyed, or greatly diminished throughout the portion of lung supplied by the obstructed tube. As a result of this, the respiration will be puerile or supplementary throughout the rest of the lung, or even upon the opposite side. When, during a violent paroxysm of cough, the body is driven from the bronchus, the murmur is at once restored, whilst, at the same time, violent spasm and dyspnoea are induced by the irritating substance impinging against the more sensitive membrane of the larynx. Now, it is precisely this alternation of symptoms which proves most characteristic of the accident under consideration. It should not, however, be concealed that many of the above signs may be owing to the plugging of a bronchial tube by a mass of inspissated mucus or lymph, as sometimes happens in "membranous bronchitis." It is also important to bear in mind that, when the body is of an

irregular shape, it will still allow the passage of air, and thus not perceptibly interfere with the respiratory murmur; and, for the same reason, such a body will not be displaced by a paroxysm of coughing, however violent. It will, therefore, be perceived that even the physical signs will occasionally fail to enlighten us upon the real nature of the case; generally speaking, however, in connection with the previous history, they will prove a valuable aid in forming a correct diagnosis. Percussion, although it affords less important indications, still merits our attention. In recent cases, the sound is always clear at first, and that even when the tube is completely obstructed; under the last-mentioned circumstances, the portion of lung from which the air is cut off becomes ultimately collapsed or condensed from an accumulation of the natural secretions, and congested condition of the mucous membrane; the percussion is now necessarily flat over this part of the lung. These various circumstances are fully dwelt upon by the author; but, as it would be impossible to follow him more closely in this short notice of his work, we must conclude this part of the subject by a single quotation, illustrating the manner in which the subject is treated:—

“When the foreign body descends below the larynx, it is usually arrested in one of the bronchial tubes—more frequently the right than the left. Under such circumstances, the respiratory murmur in the corresponding lung is generally more or less affected, as is evinced both by percussion and auscultation. The wall of the chest, however, is not, as might be supposed, always, perhaps not even generally, dull or flat, as in pneumonia and phthisis, in which the parenchymatous substance of the organ is condensed by abnormal deposits; on the contrary, the sound is frequently unnaturally clear and resonant, very much, indeed, as in pulmonary emphysema. This peculiarity is sometimes recognized over the entire lung; while at other times it is limited to particular portions, as one-half, a third, or one-fourth, according to the size and situation of the foreign body. When the extraneous substance is so large as to obstruct the bronchial tube completely, there must necessarily be marked dulness on percussion on the corresponding side of the chest, and great diminution, if not entire absence, of motion in the ribs, as I have repeatedly witnessed in the human subject, and also in my experiments on the inferior animals.”

From a careful analysis of the cases which have fallen under his observation, he concludes that when aphonia exists in connection with pain and tenderness over the larynx, and a peculiar whistling sound in respiration, there can be but little doubt that the foreign body is in the larynx. Allusion is also made to the danger of confounding the symptoms resulting from the lodgement of a foreign body in the pharynx with those produced by a similar accident affecting the windpipe; and mention is made of a surgeon, as reported by Desault, who, after opening the trachea, found, upon the death of the patient, that the offending body had been impacted in the pharynx. The rest of this chapter is devoted to the consideration of the possibility of aneurisms of the aorta, pertussis, spasm of the glottis, croup, &c. being mistaken for the lodgement of extraneous substances in the air-passages; but, as the means of diagnosis in these affections are generally so apparent, it will not be necessary to dilate upon these points.

Under the head of “Spontaneous Expulsion,” forty-nine cases are reported in full, in all of which the patients recovered after the discharge of the foreign body; in eight others, death occurred at longer or shorter periods, after the expulsion. Many of these cases have been extracted from the journals of this country and Europe; whilst not a few have been communicated by the friends of the author, and now appear in print for the first time; nine of these, indeed, occurred in his own practice.

“It has been stated that the extraneous body, when the parts relieve them-

selves spontaneously, is most commonly ejected in a fit of coughing. By a reference to the accompanying table, it will be seen that this occurred thirty-seven times out of the forty-nine; in eight, the mode of expulsion is not stated; in one, it took place in sneezing; in one, during spontaneous vomiting; and in one, in dreaming." "The period during which the body may remain in the air-tubes, after the first symptoms have passed off, varies from a few minutes to several hours, days, weeks, months, and even years. In one of the cases referred to under this head, the substance, a piece of bone, was retained sixty years." (p. 116.)

We now approach the most important part of the whole subject, namely, the treatment, both medical and surgical. From the fact that emetics are very efficacious in expelling mucous and other accumulations from the air-passages, it is not surprising that the same means have frequently been resorted to with the view of dislodging extraneous substances from the lungs. Experience, however, has shown that such hopes are delusive, and that not only much precious time is thus lost, but that even the life of the patient is endangered by the foreign body being occasionally driven into the larynx and provoking violent spasm of the glottis. The practice, too, appears to be based upon false physiological notions, since it is well known that the act of vomiting is attended by a deep and forcible inspiration, which might readily tend to wedge the substance more firmly in the lungs. In the forty-six cases alluded to by the author, in which emetics were used, "the only beneficial effect produced in any, was a slight and transient amelioration of the cough and dyspnoea. In some, their exhibition was decidedly prejudicial, causing a marked increase of the respiratory embarrassment; and in not a few, the patient seemed to have been in imminent danger of suffocation from the foreign body being forcibly impelled against the larynx in the act of vomiting;" from all which he concludes that the only cases in which they should be used, "are those in which there is great respiratory embarrassment, in consequence of the excessive accumulation of mucus in the air-cells and bronchial tubes, or in which the symptoms are of a marked asthmatic character."

Sternutatories, or even accidental sneezing, have occasionally expelled a foreign body from the air-passages; but such an occurrence is so exceedingly rare that no importance can be attached to them as remedial agents. The violent expulsive effort which attends their action, naturally tends to drive the offending body into the larynx; but the spasm excited by its presence, when it reaches this point, prevents its escape through the glottis, and may even endanger the life of the patient. To overcome these objections, Dr. Gross suggests the use of chloroform.

"The proper plan would be to make the patient inhale this fluid until he is nearly or wholly insensible, and to irritate the Schneiderian membrane with snuff, or some other substance, the moment he begins to regain his consciousness. Should sneezing ensue while he is in this condition, with the air-tubes in a state of perfect relaxation, it is easy to conceive how the foreign body might be ejected. Nature would be taken, as it were, by surprise, as she has sometimes been by a dream, as in the remarkable case occurring in the practice of Mr. Cock, of London. As the use of sternutatories, exhibited in the ordinary manner, has hitherto been almost invariably unsuccessful, I merely throw out this hint for the consideration of the reader, without feeling inclined to place much confidence in it."

Allusion is also made to the inhalation of iodine, or other irritating substances, with the view of provoking spasmodic or violent cough, and thus promote expulsion. A successful case, thus treated, is reported; but when we bear in mind that the pulmonary irritation is, in most instances, already excessive, it is difficult to conceive of the propriety of such a procedure.

Most of our readers will recollect the memorable case of Mr. Brunel, where the foreign body—a coin—was removed from the air-passages by inversion, after tracheotomy had been performed; since then, several cases of a somewhat similar character have been reported. The treatment by “inversion” is, however, only applicable to heavy substances, which by their gravity might, under favourable circumstances, escape through the chink of the glottis. Such an experiment, however, is not unattended with risk, unless, at the same time, the respiration should be maintained by an opening in the windpipe, as in the case above alluded to. Dr. Hansford, of Knoxville, Illinois, has recommended that the patient should be placed in the horizontal position upon a table or bench, with the head inclined over the edge, and, at the same time, to apply a sharp blow on the back of the chest during forcible inspiration. By means of the “maul,” as he terms it, he has succeeded in expelling water-melon seed, and other comparatively light substances, at a single blow. Others have recommended forcible inspiration, followed by sudden compression of the chest; but, however ingenious these various means may appear, a more extended experience has not confirmed their utility, and they are certainly not devoid of risk, for reasons already assigned. Before proceeding to the consideration of the surgical treatment, the author directs especial attention to the various inflammatory affections which are frequently induced by the presence of extraneous bodies; he especially cautions against the mistaken idea that the patient is necessarily safe when once the offending substance is expelled; and, after reporting a case illustrative of these views, he concludes with the following remarks:—

“The above instance is not a solitary one; the records of surgery are crowded with them. Had the patient been carefully watched, she would not have perished from an accident, from the effects of which, under proper management, hundreds have recovered. But a spark had been kindled in her lungs, which a drop of water might have extinguished in its incipency, but which, having once spread, nothing could afterwards subdue.” (p. 196.)

Chapter IX., and the seven following chapters, are devoted to the consideration of the operation of bronchotomy, including various interesting anatomical and physiological considerations relative to this subject; the whole illustrated by very numerous cases of the most interesting and instructive character. The author, in speaking of the difference in the sensibility of the mucous membrane of the trachea and bronchial tubes, as compared with that of the larynx, alludes to the experiments of Magendie; showing that if an opening be made into the windpipe, and a probe be passed up into the glottis, violent irritation and coughing are produced, while no such effect follows the introduction of the instrument into the trachea and bronchial tubes. Dr. Gross, in repeating these experiments, ascertained that the sensibility of the bronchial mucous membrane, though less than that of the larynx, was considerably greater than the lining membrane of the trachea—so that the greatest sensibility would appear to be at the two extremes. He proceeds, however, to show that the sensibility of the trachea sometimes becomes exquisite from the effects of disease, whilst, at others, all feeling appears to be destroyed. The following passage will show the estimation in which he holds the operation of bronchotomy:—

“A careful examination of the facts which are comprised in this treatise will, I think, serve to satisfy any one, however prejudiced or skeptical, that the only real safety of a person, labouring under a foreign body in the air-passages, consists in bronchotomy. We have seen, it is true, that various substances, entrapped in these passages, may be ejected, either spontaneously or through

the intervention of art, as the use of emetics and sternutatories, or even by simple inversion and succussion of the body; but no one, surely, acquainted with the subject would adduce such cases for the purpose of establishing a rule of practice."

Next follows a complete history of laryngotomy, tracheotomy, and laryngo-tracheotomy, accompanied with numerous well-executed wood-cuts, illustrating the anatomy of the parts, the necessary instruments, and the manner in which the operations should be performed. Opening the trachea in the adult has, at all times, been considered both an easy and safe operation; but in early infancy, the case is very different, since the dangers and difficulties are greatly increased by the shortness of the neck, and the great depth and small size of the trachea; the restlessness of the child also tends greatly to increase the embarrassment. To overcome this latter difficulty, Dr. Gross strongly urges the necessity of resorting to the inhalation of chloroform; in fact, in such cases, he considers it a *sine qua non*, and alludes to some successful cases in which it had been used by Drs. Kearny Rodgers, of New York, and Wm. Davidson, of Madison, Indiana. In the course of his remarks he states: "I know hardly an operation in all surgery that I would not rather undertake than this," unless aided by the use of chloroform. Never having witnessed the administration of this agent under the circumstances above alluded to, it is not in the power of the writer of this notice to speak authoritatively upon this subject; theoretically, however, there appear to be some objections to the procedure. That the inhalation of chloroform, under all circumstances, is attended with more or less risk, is fully proved by the numerous cases of sudden death from this cause now on record. Its rapid and peculiarly depressing effects upon the nervous centres—as manifested by nausea, vomiting, and feebleness of pulse—would appear especially to preclude its use in a class of patients particularly liable to the development of cerebral symptoms under slight provocations. These objections would not apply with the same force to the use of ether, which an ample experience has now shown to be comparatively safe. But, if the use of this class of remedies greatly facilitates the performance of the operation, does not the very insensibility thus induced remove one of the chief safeguards of the patient, namely, the natural irritability of the air-passages? Despite all the care the surgeon can take, and however mindful he may be of the importance of arresting all hemorrhage before opening the trachea, more or less blood will be drawn into the air-passages, and might readily produce fatal asphyxia, if not at once expelled by the violent expulsatory efforts which immediately follow the opening of the trachea. Moreover, all experience has shown that, in a vast majority of cases, the foreign body is driven through the opening immediately, or soon after the operation. Now it is quite conceivable that this fortunate result would be more or less prevented by the sedative effects of anæsthetics. It is true that the surgeon might be enabled to probe the bronchial tubes, and apply the forceps, with less embarrassment; but is there not some danger that this very freedom of action would lead to protracted and forcible manipulations, destructive to these highly organized and delicate structures, to say nothing of the important nerves and bloodvessels in juxtaposition with these parts? It is also highly probable that the inhalation of chloroform strongly predisposes to congestion of the bloodvessels about the head and neck, thus tending to increase the hemorrhage, and, consequently, the danger of the operation. In confirmation of this view, we find the following remarks upon a case in which this operation was performed by the late lamented Dr. J. Kearny Rodgers, of New York:—

"Laryngotomy was then performed at the crico-thyroid space, the patient having been previously placed under the influence of chloroform. This agent caused a good deal of congestion of the head and neck, leading to considerable hemorrhage, and the necessity of tying several vessels." (Chap. XIV. p. 417.)

The further history of this case also goes to show that the patient "suffered severely, for a number of days, from the effects of the chloroform."

The latter part of the volume contains the report of thirteen cases in which laryngotomy was followed by the expulsion of the foreign body and the recovery of the patient, and only four which had a fatal termination. Upon which the author remarks:—

"In my bibliothecal researches, comprising many hundred volumes, I have not found another example of the kind; and hence, although it is very probable that I may have overlooked some cases, it is reasonable to infer that the operation in question is rarely followed by fatal effects."

Sixty cases are reported in which tracheotomy was successfully performed for the extraction of foreign bodies, and only eight are mentioned as having been followed by death. Comparing the successful with the unsuccessful cases, he thinks that we must adopt one of two conclusions: either that the latter are much less numerous than the former, or that surgeons do not report the unsuccessful as frequently as the successful ones. He also narrates ten cases of laryngo-tracheotomy having a favourable result, and but three in which the operation proved fatal, and these were the only ones he was able to find in our periodical and systematized literature.

Although the number of cases above reported may not be considered as fully sufficient to establish any very positive deductions as to the mortality from bronchotomy, still, it must be admitted that Dr. Gross is entitled to the thanks of the profession, for thus systematizing the most important facts to be found on record upon this deeply interesting subject. He justly remarks, in his preface, that, in an inquiry of this kind, individual experience amounts to nothing, and it is only by arranging, analyzing, and tabulating isolated and scattered facts that we can hope to advance the interests of science and humanity. After a careful analysis of all the facts, the most important conclusions arrived at by the author are:—

"That bronchotomy, in none of its forms, is a hazardous operation; and that it rarely proves fatal, except when it has been too long delayed, or when it is not followed by the ejection of the offending body." "Although foreign bodies have occasionally been ejected from the windpipe under the influence of emetics, errhines, and other means, the number of such cases is too small to justify the practitioner, under any circumstances, in confiding in these different classes of remedies. Generally, indeed, their effect is to increase the respiratory suffering, and the danger of the patient, by impelling the intruder against the larynx, where its presence always excites spasm and other unpleasant symptoms."

Many other important deductions are summed up in the last chapter, which, in fact, constitutes a very perfect *résumé* of the whole matter. Appended to the work, there is also a complete index, alphabetically arranged.

In concluding this imperfect sketch of Dr. Gross's very elaborate book upon *Foreign Bodies in the Air-passages*, we feel no hesitation in recommending it to the profession as a work replete with much important and interesting matter upon the subject it purports to treat, and as well calculated to fill a void which has long been felt in our medical and surgical literature.

W. P.